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MWA  
Product Guide  
2nd Edition



## SPECIAL STEELS

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**MAC TRODE E64 W**

High quality austenitic stainless steel rutile coated electrode, depositing 23% Cr, 12% Ni, 2% W weld metal to resist corrosion, heat and friction.

Tungsten in the weld metal produces high strength, scale and general wear resistance at temperatures up to 1100°C. For joining and overlaying various steels especially heat resistant steels, HR Crown 1 type – primarily furnace applications and particularly suitable for repairs to mandrels used in hot forming of tubular components.

**Typical All Weld Metal Chemical Analysis (%)**

C	Cr	Mn	Ni	P	S	Si	W
0.065	23	1.65	12	0.010	0.015	0.50	2.00

**Typical All Weld Metal Mechanical Properties**

**As Welded**

Ultimate Tensile Strength	680 N/mm <sup>2</sup>
Elongation	30-35%
Hardness	220 Brinell

**Sizes Available and Recommended Amperages**

3.2mm	4.0mm	5.0mm
70-110	110-140	140-180

**Related Specification:**

AWS E309 Special

**Current:**

AC/DC (+)

**Storage:**

If allowed to become damp, the electrodes should be re-dried for one hour at 150°C before use.

**MAC TRODE E66**

Superior specially designed high strength austenitic type electrode of duplex structure. Can be used for overlaying and joining dissimilar steels to one another, high and low carbon steels, spring steels, tool and die steels, cast steels, ferritic to austenitic steels and steels of unknown composition.

High resistance to cracking coupled with good wear, heat, impact and corrosion resistance. Therefore this electrode has uses in practically every type of industry resulting in one of the most universally used electrodes for problem and unknown steels.

**Typical All Weld Metal Chemical Analysis (%)**

C	Cr	Mn	Mo	Ni	P	S	Si
0.095	29.8	0.99	0.92	10.1	0.026	0.015	0.75

**Typical All Weld Metal Mechanical Properties**

**As Welded**

Ultimate Tensile Strength	840 N/mm <sup>2</sup>
Elongation	25%
Hardness	220 Brinell

**Sizes Available and Recommended Amperages**

1.5mm	2.0mm	2.5mm	3.2mm	4.0mm	5.0mm	6.0mm
25-35	30-45	50-70	90-110	120-140	150-190	200-250

**Related Specification:**

AWS E312-17

**Current:**

AC/DC (+)

**Storage:**

If allowed to become damp, the electrodes should be re-dried for one hour at 150°C before use.

**MAC TRODE E66 S**

High strength rutile coated synthetic electrode for joining and overlaying dissimilar steels. Economical high recovery electrode produces a 29/9 type stainless steel weld deposit. Positive smooth arc, easy slag removal and builds up rapidly. Can be used in all positions. Ideal for buttering layers or overlaying steels to combat heat, friction and impact, where economy is of the utmost importance. Covers large areas quickly. Will join stainless to carbon steels and steels of unknown quantity.

**Typical All Weld Metal Chemical Analysis (%)**

C	Cr	Mn	Ni	P	S	Si
0.08	29.15	0.80	9.5	0.01	0.009	0.7

**Typical All Weld Metal Mechanical Properties**

**As Welded**

Ultimate Tensile Strength	695 N/mm <sup>2</sup>
Elongation	25-30%

**Sizes Available and Recommended Amperages**

2.5mm	3.2mm	4.0mm	5.0mm
80-120	120-175	160-210	200-275

**Related Specification:**

AWS E312-16-HR

**Current:**

AC/DC (+)

**Storage:**

If allowed to become damp, the electrodes should be re-dried for one hour at 150°C before use.

**MAC TRODE E66 V**

Superior high strength austenitic type electrode of duplex structure for joining and overlaying all steels. This variation of Mac Trode E66 is designed specifically to overcome difficult deslagging problems on high manganese tool steels and for inclined vertical down welding and root runs on certain thick sections. Has high resistance to cracking. Wear, heat, impact and corrosion resistant. Used for overlaying and joining dissimilar steels to one another, high and low carbon steels spring steels, tool and die steels, cast steels, ferritic to austenitic steels and steels of unknown composition.

**Typical All Weld Metal Chemical Analysis (%)**

C	Cr	Mn	Mo	Ni	P	S	Si
0.095	29.8	0.99	0.92	10.1	0.26	0.015	0.75

**Typical All Weld Metal Mechanical Properties**

**As Welded**

Ultimate Tensile Strength	840 N/mm <sup>2</sup>
Elongation	25-30%

**Sizes Available & Recommended**

2.5mm	3.2mm	4.0mm	5.0mm
80-120	120-175	160-210	200-275

**Related Specification:**

AWS E312-16

**Current:**

AC/DC (+)

**Storage:**

If allowed to become damp, the electrodes should be re-dried for one hour at 150°C before use.

**MAC TRODE E606**

Specially designed high strength austenitic type electrode of duplex structure. All purpose low amperage electrode. Easy to use with smooth arc, low spatter and even bead formulation. Can be used for overlaying and joining dissimilar steels to one another, high and low carbon steels, spring steels, tool and die steels, cast steels, and steels of unknown composition. High resistance to cracking coupled with good wear, heat, impact and corrosion resistance.

**Typical All Weld Metal Chemical Analysis (%)**

C	Cr	Mn	Mo	Ni	P	S	Si
0.11	29.5	1.06	0.87	9.65	0.02	0.01	0.95

**Typical All Weld Metal Mechanical Properties**

**As Welded**

Ultimate Tensile Strength	840 N/mm <sup>2</sup>
Elongation	25%
Hardness	220 Brinell

**Sizes Available and Recommended Amperages**

1.5mm	2.0mm	2.5mm	3.2mm	4.0mm	5.0mm	6.0mm
25-35	30-45	50-70	90-110	120-140	150-190	200-250

**Related Specification:**

AWS E312-17

**Current:**

AC/DC (+)

**Storage:**

If allowed to become damp, the electrodes should be re-dried for one hour at 150°C before use.

**MAC TRODE E616**

Superior specially designed high strength austenitic type electrode of duplex structure. All purpose low amperage electrode. Easy to use with smooth arc, low spatter and even bead formation. Can be used for overlaying and joining dissimilar steels to one another, high and low carbon steels, spring steels, tool and die steels, cast steels, ferritic to austenitic steels and steels of unknown composition. High resistance to cracking coupled with good wear, heat, impact and corrosion resistance.

Therefore this electrode has uses in practically every type of industry resulting in one of the most universally used electrodes for problem and unknown steels.

**Typical All Weld Metal Chemical Analysis (%)**

C	Cr	Mn	Mo	Ni	P	S	Si
0.095	29.8	0.99	0.92	10.1	0.028	0.015	0.75

**Typical All Weld Metal Mechanical Properties**

**As Welded**

Ultimate Tensile Strength	840 N/mm <sup>2</sup>
Elongation	25%
Hardness	220 Brinell

**Sizes Available and Recommended Amperages**

1.5mm	2.0mm	2.5mm	3.2mm	4.0mm	5.0mm	6.0mm
25-35	30-45	50-70	90-110	120-140	150-190	200-250

**Related Specification:**

AWS E312-17

**Current:**

AC/DC (+)

**Storage:**

If allowed to become damp, the electrodes should be re-dried for one hour at 150°C before use.



**MAC TRODE E630**

Tough high strength, fully austenitic electrode, designed to resist heat and impact. Fully machinable. Weld deposit will work harden under impact and retain properties at high temperatures. Easy to use in all positions producing sound welds, good build-up characteristics and good slag detachability. For joining or overlaying mild and alloy steels, spring steels, heat resisting steels, ideal for the repair of drop forging dies. Suitable for use as a buffer layer prior to hardsurfacing of manganese steel, and may be used for welding manganese steel rails or similar applications involving friction, impact or corrosion.

**Typical All Weld Metal Chemical Analysis (%)**

C	Cr	Mn	Ni	P	S	Si
0.1	20.0	5.4	10.0	0.02	0.016	0.55

**Typical All Weld Metal Mechanical Properties**

**As Welded**

Ultimate Tensile Strength	650 N/mm <sup>2</sup>
Elongation	40%
Hardness	220 Brinell
Hardness (Work Hardened)	350 Brinell

**Sizes Available and Recommended Amperages**

2.5mm	3.2mm	4.0mm	5.0mm	6.0mm
60-95	70-120	110-140	130-160	120-200

**Related Specification:**  
AWS A5.4 E307-16 | Type 20.10.4 Mn

**Current:**  
AC/DC (+)

**Storage:**

If allowed to become damp, the electrodes should be re-dried for one hour at 250°C before use.

**MAC TRODE E630 S**

Tough high strength, synthetic austenitic electrode designed to resist heat and impact. Fully machinable, with a recovery rate of 170%. Easy to use in all positions producing sound welds, good build-up characteristics and good slag detachability. Weld deposit will work harden under impact and retain properties at high temperatures. For joining and overlaying mild and alloy steels, spring steels and heat resisting steels. Suitable for use as a buffer layer prior to hard surfacing of manganese steel and may be used for welding manganese steel rails or similar applications involving friction, impact or corrosion.

**Typical All Weld Metal Chemical Analysis (%)**

C	Cr	Mn	Ni	P	S	Si
0.1	22.0	4.15	10.0	0.02	0.016	0.55

**Typical All Weld Metal Mechanical Properties**

**As Welded**

Ultimate Tensile Strength	620 N/mm <sup>2</sup>
Elongation	40%
Hardness	220 Brinell
Hardness (Work Hardened)	300 Brinell

**Sizes Available & Recommended**

2.5mm	3.2mm	4.0mm	5.0mm	6.0mm
60-95	95-120	120-140	140-160	160-200

**Related Specification:**  
AWS A5.4 E307-26 RMP

**Current:**  
AC/DC DC(+)

**Storage:**

If allowed to become damp, the electrodes should be re-dried for one hour at 250°C before use.

**MAC TRODE E631**

The electrode has a basic lime rutile flux coating and is so alloyed to deposit a martensitic precipitation hardening Cr-Ni-Mo-Cu weld metal. Excellent weldability combined with good slag detachability. The smaller diameters, e.g. 2.50 & 3.20mm can be used in all positions. Designed to weld Firth Vickers 520 and alloy 450 (USA). The corrosion resistance of the weld is similar to 304 stainless but its yield strength is 3 times greater. The weld is slightly under alloyed compared to FV 520 to compensate for the faster cooling rates of the weld metal to castings but responds in an identical manner to PWHT as FV 520.

**Typical All Weld Metal Chemical Analysis (%)**

C	Cr	Cu	Mn	Mo	Nb	Ni	P	S	Si
0.4	13.9	1.5	0.6	1.5	0.3	5.00	0.02	0.02	0.4

**Typical All Weld Metal Mechanical Properties**

**As Welded**

Ultimate Tensile Strength	1230 N/mm <sup>2</sup>	
0.2% Proof Stress	1110N/mm <sup>2</sup>	
Elongation	12%	
Reduction of Area	30%	
Hardness	410 HV	
PWHT	850°C - 2hr	450°C - 4hr

**Sizes Available and Recommended Amperages**

2.5mm	3.2mm	4.0mm	5.0mm
70-100	100-130	150-190	200-240

**Related Specification:**

N/A

**Current:**

DC (±) AC (OCV 80 amps)

**Storage:**

If allowed to become damp, the electrodes should be re-dried for one hour at 250°C before use.

**MAC TRODE E6130**

High recovery rutile type electrode for welding, surfacing and building up manganese steel components. Weld deposits have excellent impact resistance and rapid work hardening properties. For applications where a hard surface, resistant to wear under heavy impact and battering is required. For weld reclamation of crushers, railway frogs and crossings and for reclamation of defective manganese steel castings. For welding manganese steels to each other or to mild and low alloy steels. Cool between runs on thick sections to prevent surface fissuring.

**Typical All Weld Metal Chemical Analysis (%)**

C	Cr	Mn	Ni
0.8	5.0	13.0	3.0

**Typical Hardness Values**

As Welded	230-245 Brinell - 20 Rockwell C
Work Hardened	480-550 Brinell - 50 Rockwell C

**Deposited Weld Metal Structure**

To achieve required properties and analyses at least 3 layers of weld metal must be deposited, when welding on mild and low alloy steels. Keep work piece as cool as possible to achieve maximum weld soundness. Water quench if necessary.

**Sizes Available & Recommended**

2.5mm	3.2mm	4.0mm	5.0mm	6.0mm
80-110	110-140	150-180	180-210	210-240

**Related Specification:**

AWS E Fe Mn-A

**Current:**

AC/DC (+)

**Storage:**

If allowed to become damp, the electrodes should be re-dried for one hour at 150°C before use.

**MAC TRODE E6410**

High quality low hydrogen type electrode specially designed for welding 12% Cr martensitic steel which air hardens to produce high strength. (For increased toughness use E6410NM) . Easy to strike and restrike, smooth flowing electrode with low spatter and excellent slag detachability. Welds are of a smooth flat appearance. For joining and the repair of wrought and cast steels subject to corrosion and oxidation. If post weld heat treatment is not possible then an austenitic type stainless steel electrode should be used.

**Typical All Weld Metal Chemical Analysis (%)**

C	Cr	Cu	Fe	Mn	Mo	Ni	P	S	Si
0.045	12.8	0.04	BAL	0.62	0.20	0.3	0.01	0.009	0.34

**Typical All Weld Metal Mechanical Properties**

**As Welded**

Property	Value
Ultimate Tensile Strength	520 N/mm <sup>2</sup>
Elongation	18%
0.2% Proof Stress	280 N/mm <sup>2</sup>
Reduction of Area	52%
Impact Energy @ -20°C	50J

**Sizes Available and Recommended Amperages**

2.5mm	3.2mm	4.0mm
70-110	80-140	100-170

**Related Specification:**

AWS A5.4 E410-16

**Current:**

AC/DC (+) (AC Min 70 OCV)

**Storage:**

If allowed to become damp, the electrodes should be re-dried for one hour at 150°C before use.

**MAC TRODE E6410 HR**

Basic flux coated low hydrogen electrode made on a mild steel core wire with iron powder and alloying elements added to the flux to provide a martensitic weld metal containing a nominal 12% Cr with smaller levels of Ni and Mo. Mac Trode E6410-25 electrodes are designed for welding 410 (12Cr) martensitic stainless steels such as ASTM 410, 403, cast A487 grade CA15 BS410 S21 (EN56A) 410C21 and 403 C21. Such materials and weld metal are heat resistant up to 580°C and display reasonable creep resistance up to 550°C. Metal recovery is some 120% with respect to the core wire and 3.25mm electrodes may be used for positional welding.

**Typical All Weld Metal Chemical Analysis (%)**

C	Cr	Cu	Mn	Mo	Ni	P	S	Si
0.04	12.0	0.04	0.7	0.30	1.4	0.020	0.001	0.4

**Typical All Weld Metal Mechanical Properties**

**Post Weld H.T**

**Min**

Property	Value
Ultimate Tensile Strength	620 N/mm <sup>2</sup>
Elongation	18%
0.2% Proof Stress	450 N/mm <sup>2</sup>
Hardness	<22 HRC
Charpy Vee Notch @ +20°C	60J
Charpy Vee Notch @ -10°C	50J

**Sizes Available and Recommended Amperages**

3.2mm	4.0mm	5.0mm
70-140	95-180	140-250

**Related Specification:**

AWS E410-26

**Current:**

DC (+) or AC (Min OCV 80)

**Storage:**

If allowed to become damp, the electrodes should be re-dried for one hour at 150°C before use.



**MAC TRODE E6410 NM**

High quality superior low hydrogen type electrode for welding high strength martensitic corrosion resistant stainless steel. Has moisture resistant rutile flux coating with a recovery rate of approximately 130%. Easy to strike and restrike, smooth flowing electrode with low spatter and excellent slag detachability. Welds are of a smooth flat appearance. For welding high strength corrosion resistant martensitic stainless and cast steels which have superior sulphide-induced SCC hydro-cavitation properties (when compared with plain 12% Cr steels).

**Typical All Weld Metal Chemical Analysis (%)**

C	Cr	Fe	Mn	Mo	Ni	P	S	Si
0.06	12.4	BAL	0.24	0.51	4.45	0.01	0.007	0.24

**Typical All Weld Metal Mechanical Properties**

<b>As Welded</b>	
Ultimate Tensile Strength	550 N/mm <sup>2</sup>
Elongation	17%
0.2% Proof Stress	470 N/mm <sup>2</sup>
Reduction of Area	45%
Impact Energy @ -20°C	50J

**Sizes Available and Recommended Amperages**

3.2mm	4.0mm	5.0mm
70-110	80-140	100-170

**Related Specification:**  
AWS A5.4 E410-Ni Mo-16

**Current:**  
AC/DC (+)

**Storage:**

If allowed to become damp, the electrodes should be re-dried for one hour at 150°C before use.

**MAC TRODE E6412**

Manufactured using a low carbon, high purity ferritic core wire with a rutile metal powder flux containing chromium as the main alloying element. Weldability and weld metal appearance are excellent, allowing contact welding with low spatter levels and readily detachable slag. A specially designed electrode for welding wrought alloys such as ASTM A176, A276 and A446, which contain a nominal 25% Cr and possesses similar resistance to oxidation in sulphurous reducing conditions up to 1100°C. The electrode may be used to weld similar alloyed cast materials and applications including, furnace parts, oil burners and flue stack liners.

**Typical All Weld Metal Chemical Analysis (%)**

C	Cr	Fe	Mn	Ni	P	S	Si
0.05	28	BAL	0.4	0.1	0.012	0.01	0.6

**Typical All Weld Metal Mechanical Properties**

<b>As Welded</b>	
Ultimate Tensile Strength	560 N/mm <sup>2</sup>
Elongation	17%
0.2% Proof Stress	400 N/mm <sup>2</sup>
Reduction of Area	42%

**Sizes Available and Recommended Amperages**

2.5mm	3.2mm	4.0mm	5.0mm
70-110	110-140	150-200	200-250

**Related Specification:**  
Known as 28RMP

**Current:**  
AC/DC (+)

**Storage:**

If allowed to become damp, the electrodes should be re-dried for one hour at 180°C before use.

**MAC TRODE E6430**

MMA type welding electrode manufactured on a pure low carbon core wire with a recovery rate of 130% with respect to the core wire. This electrode has a moisture resistant coating giving very low weld metal hydrogen levels. It has good scaling resistance in air up to 820°C and low corrosion rate in sulphur bearing gases e.g. in H<sub>2</sub>/H<sub>2</sub>S mixtures some 5 to 10 times better than 12% Cr steels at 300°C-500°C. Mac Trode E6430 is immune to hydrogen attack at high temperatures and will resist stress corrosion cracking in boiling chloride, nitrate and alkali solutions. Used in the cast and wrought form in industries such as chemical, petrochemical and steam generating industries. It is also suitable for welding Cr Si Al steels with up to 18% Cr, used for furnace parts and exhaust ducting.

**Typical All Weld Metal Chemical Analysis (%)**

C	Cr	Cu	Mn	Mo	Ni	P	S	Si
0.08	17.0	0.05	0.40	0.5	0.10	0.015	0.010	0.30

**Typical All Weld Metal Mechanical Properties**

<b>As Welded</b>	
Ultimate Tensile Strength	520 N/mm <sup>2</sup>
Elongation	24%
0.2% Proof Stress	360 N/mm <sup>2</sup>
Reduction of Area	50%

**Sizes Available and Recommended Amperages**

2.5mm	3.2mm	4.0mm
70-110	80-140	100-180

**Related Specification:**

AWS A5.5 E430-16

**Current:**

DC (+) (OCV 70 amps) min

**Storage:**

If allowed to become damp, the electrodes should be re-dried for one hour at 150°C before use.

**MAC TRODE E6502**

Low hydrogen manual metal arc electrode using a silicon free, low nitrogen C Mn core wire with a moisture resistant, chemically basic flux with a controlled iron powder addition. All positional electrode with good slag control. Easy to strike electrode which produces porosity free weld deposits. Exhibits good crack resistance and excellent resistance to oxidation at temperatures up to 650°C. For assembly welding of creep resistant steels with 5% Cr, 0.5% Mo and closely related grades. Used for pipe welds in the petrochemical industry.

**Typical All Weld Metal Chemical Analysis (%)**

C	Cr	Mn	Mo	P	S	Si
0.06	5.0	0.7	0.55	0.01	0.01	0.3

**Typical All Weld Metal Mechanical Properties**

<b>As Welded</b>	
Ultimate Tensile Strength	470 N/mm <sup>2</sup>
Elongation	32%
0.2% Proof Stress	230 N/mm <sup>2</sup>

**Sizes Available and Recommended Amperages**

2.5mm	3.2mm	4.0mm	5.0mm
70-90	90-130	130-180	160-220

**Related Specification:**

AWS A5.5 E502-15 (Generic) | AWS A5.5 E8018-B6

**Current:**

AC/DC (+)

**Storage:**

If allowed to become damp, the electrodes should be re-dried for one hour at 150°C before use.

**MAC TRODE E6505**

A low hydrogen manual metal arc electrode using a silicon free, low nitrogen C Mn core wire with a moisture resistant chemically basic flux with a controlled iron powder addition. All positional electrode with good slag control. Exhibits good crack resistance. Mac Trode E6505 is designed specifically for welding a range of 9% Cr Mo forged and cast steels, for use in the fabrication and repair of pressure vessels.

**Typical All Weld Metal Chemical Analysis (%)**

C	Cr	Fe	Mn	Mo	Ni	P	S	Si
0.06	9.56	BAL	0.73	1.15	2.14	0.01	0.015	0.55

**Typical All Weld Metal Mechanical Properties**

**As Welded**

Ultimate Tensile Strength	520 N/mm <sup>2</sup>
Elongation	32%
0.2% Proof Stress	480 N/mm <sup>2</sup>
Reduction of Area	75%
Impact Energy @ -10°C	35J

**Sizes Available and Recommended Amperages**

2.5mm	3.2mm	4.0mm	5.0mm
70-90	90-130	130-180	160-220

**Related Specification:**  
AWS E505-15 (Generic) | AWS E8018-B8

**Current:**  
AC/DC (+)

**Storage:**

If allowed to become damp, the electrodes should be re-dried for one hour at 150°C before use.

**MAC TRODE E6630**

Low hydrogen manual metal arc electrode using a silicon free, low carbon, high purity, C:Mn core wire with a concentrically extruded, moisture resistant rutile flux, with a recovery rate of approximately 130% with respect to core wire. Easy to strike electrode which produces porosity free weld deposits.

**Typical All Weld Metal Chemical Analysis (%)**

C	Cr	Cu	Fe	Mn	Ni	P	S	Si
0.076	15.20	2.10	BAL	0.70	4.10	0.010	0.010	0.40

**Typical All Weld Metal Mechanical Properties**

**As Welded**

Ultimate Tensile Strength	520 N/mm <sup>2</sup>
Elongation	36%
0.2% Proof Stress	280 N/mm <sup>2</sup>
Reduction of Area	52%
Impact Energy @ -20°C	50J

**Sizes Available and Recommended Amperages**

2.5mm	3.2mm	4.0mm
70-110	80-140	100-180

**Related Specification:**  
AWS A5.5 E630-16

**Current:**  
DC (+) (OCV 70 amps) min

**Storage:**

If allowed to become damp, the electrodes should be re-dried for one hour at 150°C before use.

**MAC TRODE RAIL ROD**

High recovery (115%) Low Hydrogen electrode for the welding of rails. Due to the excellent resistance to compressive loading, this electrode is ideal for the welding of rail steels. Low and medium Carbon rail steels. Minimal slag formation permits a slag over slag technique. Ideally Pre-Heat to 200-250C and maintain an inter pass temperature of around 400C.

**Related Specification:**

N/A

**Current:**

DC (+) or AC (OCV 70V min)

**Storage:**

If allowed to become damp, the electrodes should be re-dried for one hour at 150°C before use.

**Typical All Weld Metal Chemical Analysis (%)**

C	Cr	Mn	Mo	Ni	P	S	Si
0.1	2.3	1.2	0.3	0.2	0.01	0.008	0.5

**Typical All Weld Metal Mechanical Properties****As Welded**

Ultimate Tensile Strength	900 N/mm <sup>2</sup>
Elongation	17%
0.2% Proof Stress	700 N/mm <sup>2</sup>
Hardness (HV)	280

**Sizes Available and Recommended Amperages**

3.2mm	4.0mm	5.0mm	6.0mm
100-160	140-190	200-280	230-370